

# A CHECKLIST OF THE NATURALIZED VASCULAR PLANTS OF WESTERN AUSTRALIA II: CHANGES 1994–2004

By GREG KEIGHERY

Western Australian Conservation Science Centre,  
Department of Environment and Conservation,  
Locked Bag 104, Bentley Delivery Centre, Western Australia, 6983.

## ABSTRACT

Weed numbers continue to increase at a steady rate, but explanations of the causes are often lacking. Checklists of naturalised plants for Western Australia produced in 1994, 1999 and 2004 were used to collate the reasons for these new records.

Between these checklists the number of recorded naturalised taxa rose from 1,073 to 1,234. The major causes of these differences were increased survey effort which added 105 previously unrecorded weeds. Literature survey / taxonomic revisions added another 95, highlighting the importance of timely taxonomic studies of collections of weeds and the need to systematically incorporate this information into databases. During this period 47 species previously listed as naturalised were deleted, but 94 taxa on the verge of becoming naturalised were also added as garden escapes.

Despite many “new” records being the result of increased taxonomic effort, the number of naturalised species continues to increase at a steady rate (the number of completely new records occurring at a rate of approximately 10 per year over the survey period). Approximately 70% of these new weeds were deliberately introduced as ornamentals or for agriculture.

## INTRODUCTION

In 1994 I prepared a checklist of the naturalized weeds of Western Australia, with particular reference to environmental weeds (Keighery 1995). This list was used as the basic list for “Western Weeds”, the State weed

field guide (Hussey *et al.* 1997). An interim updated list was prepared in 1999 (Keighery 1999) and a new checklist of weeds distributed in natural regions of Western Australia was prepared in 2003 (Keighery and Longman 2004).

The weed flora of any region is highly dynamic, with species previously recorded being shown not to be naturalised, being eradicated or failing to naturalise. However, the recorded weed flora of Australia continues to increase rapidly despite these corrections and deletions. This was also true for the decade between the checklists in Western Australia, where the number of recorded naturalised taxa recorded rose from 1,073 to 1,234, a rate of nearly 20 new records per year.

The reasons for these increases are of considerable interest to managers of weeds as they can indicate where to target education and prevention campaigns to slow these increases.

One method of quantifying changes to the weed flora of Western Australia is to examine the causes of the differences between these checklists. I was requested by the Weed Society to attempt to undertake such an analysis and this paper documents the changes in the decade between the 1994 list and the 2004 list.

This is the second in a series of papers dealing with the naturalised vascular plants of Western Australia. The first produced a new checklist of Weeds distributed in natural regions for Western Australia (Keighery and Longman 2004).

## RESULTS

Table 1 summarizes the three

**Table 1.** Summary of Checklists of Naturalized Vascular Plants of Western Australia

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<b>Keighery 1994</b>
6 Ferns; 7 Conifers; 318 Monocotyledons; 701 Dicotyledons Total: 1,032
41 listed as doubtfully naturalized Garden Escapes not listed
<b>Keighery 1999</b>
6 Ferns; 12 Conifers; 342 Monocotyledons; 795 Dicotyledons Total: 1,155
41 still listed as doubtfully naturalized 81 "Garden Escapes"
<b>Keighery and Longman 2004</b>
12 Ferns; 15 Conifers; 345 Monocotyledons; 862 Dicotyledons Total: 1,234
47 deleted (13 no longer naturalized; 34 no evidence) 94 "Garden Escapes"

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checklists of the naturalised vascular flora of Western Australia. In 1994 there were 1,032 naturalised plant taxa recorded for Western Australia. This number rose to 1,073 if one included the 41 species Keighery (1995) listed as doubtfully naturalised for which there was an old herbarium specimen in the Western Australian Herbarium (PERTH) with no additional information apart from an often general locality.

In order to increase accuracy a new category of garden escape (Keighery 1983, 1986) was also introduced in the 1999 checklist. This was to document those species either:

- recorded as present in management plans, reserve or

- bushland checklists but lacking other information, or
- those which were known to be either spreading slowly via vegetative means or seed, or
  - present as a single population or very localised.

Such species are either in the process of naturalizing but are easily eradicated either by chance or deliberate action. These species now numbering 94 in total have a large component of Australian natives (25 of 94 or 26.6%), suggesting these may form a potential reservoir of future weeds (Keighery 2002). Recent statements in significant horticultural literature (Clayton 2006 – “There is no such thing as a native weed in Australia; plants that cause problems all come from overseas”) suggest that there is still a considerable need for public education in this area.

By 2004 the number of naturalised plants (species, subspecies and varieties) had risen from 1032 to 1234 (Table 1), an apparent increase of 19.6%, despite 47 species (4.6%) being deleted as no longer naturalized. These were almost entirely the 41 species listed as doubtfully naturalized in 1994.

The greatest percentage changes occurred in the ferns (6 to 12; up 100%), the Gymnosperms (7 to 15; up 114%) and in the Dicotyledons (701 to 865; up 18.7%).

Table 2 presents as an annotated list those taxa in family alphabetical order (following the checklist order) which were

added to the list of naturalized plants between 1994 and 2004, with details as to the source of the record (literature, field survey or a new record and the reference or voucher collection of that record). In order to have a complete checklist the 2004 list (Keighery and Longman 2004) should be read in conjunction with Table 2 presented here.

From these listings it is immediately apparent that the changes in the listings originated in two distinct categories, either

- 1: from survey work, or
- 2: from extensive review of taxonomic literature (revisions, Flora of Australia treatments, State and local Floras) and weed workers personal communications that occurred after the 1994 list was prepared.

## NEW WEED RECORDS

There were 105 previously unrecorded weeds added to the list between 1994 and 2004 (Table 2), 27 of these were recorded in the tropical Kimberley, 5 in the deserts (ranging from the Tanami to the Nullarbor) and 73 from the Mediterranean southern Western Australia.

This paper also lists five new weed records (*Freesia laxa*, *Lapeirousia anceps*, *Arabidopsis thaliana*, *Heliophila* sp (Gunyidi) and *Euphorbia chamaesyce*) recorded for Western Australia since the publication of the 2004 checklist.

**Table 2.** Annotated List of changes to the Weed Flora of Western Australia 1994–2004.  
**Key:** A.P.B. Agriculture Protection Board; det. Determined by expert

Taxon	Reason Introduced	Record Source	Location /date/voucher/reference
<b>Ferns</b>			
<b>SALVINIACEAE</b>			
Azolla filiculoides	Weedy native	Literature/survey	Keighery & Longman 2004
Azolla pinnata	Weedy native	Literature/survey	Keighery & Longman 2004
<b>DENNSTAEDIACEAE</b>			
Histopteris incisa	Ornamental	New record	Keighery & Longman 2004
Hypolepis dicksonioides	Ornamental	Literature/survey	Brownsey 1998
Preridium esculentum	Weedy native	Literature/survey	Keighery & Longman 2004
<b>Gymnosperms</b>			
<b>CUPRESSACEAE</b>			
Callitris rhomboidea	Timber	New record	Pemberton, 1997, Keighery 14587
Cupressus sempervirens	Ornamental	New record	Hamel, 1995, Keighery 14022
<b>PINACEAE</b>			
Pinus canarientis	Timber	New record	Pemberton, 2001, Turnbull 292
Pinus halepensis	Timber	New record	Perth, 1995, Keighery 14110
Pinus palustris	Timber	New record	Pemberton, 1997, Keighery 14588
Pinus pinea	Timber	New record	Reserve 32800, 1984, Burgmann 4272
Pinus ponderosa	Timber, food	New record	Hollyoake, 1/12/2001, Keighery s.n.
<b>Monocotyledons</b>			
<b>AGAVACEAE</b>			
Furcraea selloa	Ornamental	New record	Mosman Park, 1995, Lepschi & Lally 1780
Yucca aloifolia	Ornamental	New record	Busselton, 1990, G. Keighery 9116

Table 2 (cont.)

Taxon	Reason Introduced	Record Source	Location /date/voucher/reference
ALISMATACEAE			
<i>Sagittaria platyphylla</i>	Ornamental	New record	Canning River, 1997, Vincent s.n.
AMARYLLIDACEAE			
<i>Nerine bowdenii</i>	Ornamental	New record	Mount Barker, 1997, Keighery 14607
<i>Pancratium maritimum</i>	Ornamental	New record	Woodmans Point, 12/1999, Lyons s.n.
AREACACEAE			
<i>Phoenix roebelenii</i>	Ornamental	New record	Kununurra, 1996, Keighery 14397
ASPARAGACEAE			
<i>Asparagus plumosus</i>	Ornamental	New record	Bunbury, 1995, Keighery 14013
<i>Asparagus scandens</i>	Ornamental	New record	Denmark, 2001, K.Brown et N. Gibson 601
COMMELINACEAE			
<i>Murdannia nudiflora</i>	Unknown	New record	Mitchell Plateau, 1980, Keighery 2705
<i>Tradescantia albiflora</i>	Ornamental	New record	Yagan Reserve, 2004, Keighery 16855
CYPERACEAE			
<i>Cyperus laevigatus</i>	Unknown	Prev. considered cosmopolitan native	Listed as native by Wilson 2000a. In WA listed as a weed by Paczkowska & Chapman 2000
HYDROCHARITACEAE			
<i>Elodea canadensis</i>	Ornamental	Literature, no specimens in PERTH	listed as a weed by Paczkowska & Chapman 2000
IRIDACEAE			
<i>Diets grandiflora</i>	Ornamental	New record	Kalamunda, 2002, G & B Keighery 201
<i>Iris laevigata</i>	Ornamental	New record	Lake Powell, 2002, B & G Keighery 175
<i>Freesia laxa</i>	Ornamental		Canning Mills, 2003, Turton s.n.
<i>Lapierousia anceps</i>	Ornamental		Kalbarri, 2001, B & D. Bellairs 6223

JUNCACEAE						
<i>Juncus effusus</i>	Unknown	Literature record	Wilson 2000b			
<i>Juncus gerardii</i>	Unknown	Literature record	Wilson 2000b			
<i>Juncus imbricatus</i>	Unknown	Taxonomic and New record	Mount Barker, 1979, ID 1994			
JUNCAGINACEAE						
<i>Triglochin bulbosa</i>	Unknown	New record	Swan Valley, 1994, A. Worz 01			
POACEAE						
<i>Agrostis capillaris</i> var <i>aristata</i>	Unknown	Taxonomic.	Wheeler et al. 2002			
<i>Agrostis capillaris</i> var <i>capillaris</i>	Unknown	Divided into 2 varieties prev. only at species level				
<i>Aristida ramosa</i>	Unknown	Literature	Proposed as eastern Australian introduction (WA Herbarium, 1998-)			
<i>Axonopus fissifolius</i>	Lawn grass	New record	Gibb River Station, 1996, A.A. Mitchell 4441			
<i>Bromus molliformis</i>	Contaminant	Literature	Jacobs & Hastings 1993			
<i>Bromus tectorum</i>	Contaminant	Literature	Jacobs & Hastings 1993			
<i>Cynodon nlemfuensis</i> var <i>nlemfuensis</i>	Lawn grass	New record	Mitchell River Station, 1996, A.A. Mitchell 4350			
<i>Digitaria aequigulumis</i>	Unknown	New record	Bullsbrook, 1995, Lepschi & Lally 2486			
<i>Eragrostis barrelieri</i>	Unknown	Revision	Lazarides 1997			
<i>Eragrostis mexicana</i>	Unknown	Revision	Lazarides 1997			
<i>Eragrostis tenuifolia</i>	Unknown	Revision	Lazarides 1997			
<i>Glyceria declinata</i>	Unknown	Taxonomic review, 1996	Wheeler et al.2002			
<i>Oryza rufipogon</i>	Unknown	Literature	Wheeler et al.1992			
<i>Panicum coloratum</i>	Unknown	Literature	Webster 1987			
<i>Paspalum plicatulum</i>	Unknown	Literature	Webster 1987			
<i>Paspalum scrobiculatum</i>	?Weedy native	Literature	Webster 1987			
<i>Sporobolus pyramidalis</i>	Unknown	Weed of irrigated pastures	A.P.B. pers. com.			
<i>Vulpia muralis</i>	Unknown	Literature	Wheeler et al.2002			

Table 2 (cont.)

Taxon	Reason Introduced	Record Source	Location /date/voucher/reference
<b>POTAMOGETONACEAE</b>			
Potamogeton crispus	Ornamental	Literature record Flora of Perth Region, 1986.	Mongers Lake, 1983, N. Marchant 83/1
<b>Dicotyledons</b>			
<b>ACANTHACEAE</b>			
Thunbergia alata	Ornamental	New record	Augusta, 1998, Keighery 15618
<b>AIZOACEAE</b>			
Trianthema portulacastrum	Unknown	Literature record	Wheeler et al.1992
Delosperma vinaceum	Ornamental	New record	Abrolhos Islands, Keighery 16023
<b>AMARANTHACEAE</b>			
Gomphrena celosioides	? Contaminant	Taxonomic review, 1995	Palmer 1998
Guilleminea densa	Lawn weed	New record	Broome, 1992, A.A. Mitchell 2214
Ptilotus polystachyus	Weedy native	Literature/survey	A.P.B., pers. com.
<b>ANNONACEAE</b>			
Annona squamosa	Ornamental	Literature record	Kununurra A. Start pers. com.
<b>APIACEAE</b>			
Anthriscus caucalis	Contaminant	New record	Capel, 11/2001, Reeves s.n.
Coriandrum sativum	Herb/ Ornamental	New record	Muchea, 29/10/1996, Hussey s.n.
<b>APOCYNACEAE</b>			
Allamandra cathartica	Ornamental	New record	Koolan Island, 1993, G. Keighery & N. Gibson 91



<i>Calotropis gigantea</i>	Ornamental	Literature record, naturalised collections Broome, Kalumburu 2001	listed by Forster, 1992, not listed by Forster, 1996
ASCELPIDACEAE			
<i>Orbea variegata</i>	Ornamental	New record	Boulder, 24/12/2002, P. Curry s.n.
ASTERACEAE			
<i>Ageratum conyzoides</i>	Ornamental	Literature ?naturalised, last record 1970, reported	PERTH collections sorted 1996
<i>Chrysanthemum segetum</i>	Ornamental	recollected in 2000	Bunbury, 1970, CV Cahill 01
<i>Chrysocoma coma-aurea</i>	Ornamental	New record	Kings Park, 1995, Keighery 14109
<i>Cotula australis</i>	Weedy native	Literature/survey	Keighery & Longman 2004
<i>Cotula coronopifolia</i>	Weedy native	Literature/survey	Keighery & Longman 2004
<i>Eclipta</i> sp. Perth (S. Lloyd s.n. 3/4/1998)	Ornamental	New record	Yule Brook, 3/1997, S. Lloyd s.n.
<i>Gazania rigens</i>	Ornamental	New record	Albany, 2000, Keighery 16029
<i>Leontodon hispidus</i> subsp. hispidus	Unknown	New record	Normalup, 1999, Funk 12225
<i>Matricaria recutita</i>	Unknown	New record	Coorow, 23/9/1998, P. Stubbs s.n.
<i>Senecio condylus</i>	?Weedy native	Revision, Thompson, 2005 record/survey	Mitchell Freeway, 2003, G. Keighery 16775
BORAGINACEAE			
<i>Cynoglossum amabile</i>	Crop weed	Re-collected in 2000,	A.P.B. pers. com.
<i>Myosotis discolor</i>	Unknown	A. P. B. pers. com.	Cowaramup, 1955, Royce 5177
BRASSICACEAE			
<i>Arabidopsis thaliana</i>	Unknown	New record	Yalgorup, 1996, Keighery 14455
<i>Cardamine</i> sp Jandakot (P.Luff s.n., 4/7/1969)	Contaminant	Collections ID by I. Thompson, 1998	
<i>Heliphila</i> sp Gunyidi (R.Rees 42)	Unknown	New record	Gunyidi, 2003, R.Rees 42



Table 2 (cont.)

Taxon	Reason Introduced	Record Source	Location /date/voucher/reference
<i>Raphanus sativus</i>	Food	New record	Abrolhos, 1987, J.J. Alford 687
<i>Rorippa palustris</i>	Unknown	Unknown	Hewson 1982
CACTACEAE			
(Austro)cylindropuntia	Ornamental	New record	Quobba Station, 18/9/2000, L.Stace s.n.
cylindrica) <i>Cylindropuntia fulgida</i> var <i>mamillata</i>			
<i>Cylindropuntia rosea</i> (tunicata)	Ornamental	New record	Menzies, 22/10/2002, S. Januszkiewicz s.n.
<i>Opuntia lindheimeri</i>	Ornamental	New record, redet 1998	Chapman Valley, 19/2/1990, R.L. Chant s.n.
<i>Opuntia vulgaris</i>	Ornamental	New record	Queens Park, 1999, G. Keighery 15868
CAESALPINACEAE			
<i>Delonix regia</i>	Ornamental	New record	Koolan Island, 1993, G. Keighery & N. Gibson 59
<i>Senna alata</i>	Ornamental	New record	Koolan Island, 1993, G. Keighery & N. Gibson 77
<i>Senna barclayana</i>	Ornamental	Literature record	Randall & Barlow 1998
<i>Senna tora</i>	Ornamental	Literature record	Randall & Barlow 1998
CARYOPHYLLACEAE			
<i>Cerastium comatum</i>	Unknown	New record	Hillman NR., 1999, Keighery & Gibson 799
<i>Cerastium pumilum</i>	Unknown	Taxonomic review	Adams pers. com.
<i>Cerastium vulgare</i>	Unknown	Taxonomic review	Adams pers. com.
<i>Illecebrum verticillatum</i>	Unknown	New record	Dunnsborough, 1996, Ohlemuller 252
<i>Silene longicaulis</i>	Unknown	Taxonomic review	Adams pers. com.
<i>Stellaria multiflora</i>	Unknown	Taxonomic review	Adams pers. com.
CASUARINACEAE			
<i>Allocasuarina huegeliana</i>	Ornamental	New record, weedy native	Kings Park, 1995, G. Keighery 13990
CHENOPODIACEAE			
<i>Atriplex amnicola</i>	Fodder, rehabilitation	Literature record	Wilson 1984

Atriplex canescens	Ditto	Literature record	Wilson 1984
Atriplex lentiformis	Ditto	Literature record	Wilson 1984
Atriplex leptocarpa	Ditto	Literature record	Wilson 1984
Atriplex limbata	Ditto	Literature record	Wilson 1984
Atriplex semibaccata	Weedy native	Literature record	Wilson 1984
Atriplex undulata	Fodder, rehabilitation	Literature record	Wilson 1984
Chenopodium giganteum	Food, contaminant	Literature record	Wilson 1983
Chenopodium pumilio	Weedy native	Literature record	Wilson 1983
Scleroblitum atriplicinum	Fodder	New record	Ravensthorpe, 1999, E. Tink 361
Suaeda baccifera	Fodder	Literature record	Wilson 1983
CONVOLVULACEAE			
Convolvulus sabatius	Ornamental	New record	Claremont, 1996, Keighery 14041
subsp. mauritanicus			
Dichondra micrantha	Ornamental	New record	Woodvale Nature Reserve, 1992, Keighery 13522
Evolvulus nummularius	Unknown	New record	Kununurra, 1993, A.A. Mitchell 2832
Ipomoea batatas	Food	New record	Lake Kununurra, 1995, A.A. Mitchell 3846B
Ipomoea carnea	?Ornamental	New record	N.E. of Kununurra, 1992, A.A. Mitchell 2620
subsp. fistulosa			
Ipomoea pes-tigridis	Ornamental	New record	Kalumburu, 1992, A.A. Mitchell 2471
Ipomoea triloba	Ornamental	New record	Oombulgurri, 1998, A.A. Mitchell 5561
Operculina turpethum	Unknown	New record	Lake Kununurra, 1998, A.A. Mitchell 5572
CRASSULACEAE			
Bryophyllum delagoense	Ornamental	New record	Rat Island, 5/11/1999, Longman & Harvey s.n.
Crassula arborescens (ovata)	Ornamental	New record	City Beach, 1998, G. Keighery 15880
Portulacaria afra	Ornamental	New record	Kalgoorlie, 2002, G. & B. Keighery 157
EUPHORBIACEAE			
Euphorbia australis	Weedy native	literature record	Keighery & Longman, 2004
Euphorbia chamaesyce	Contaminant	Literature record / taxonomic revision	Keighery & Longman, 2004
Euphorbia drummondii	Weedy native	Literature record	Keighery & Longman, 2004
subsp. drummondii			

Table 2 (cont.)

Taxon	Reason Introduced	Record Source	Location /date/voucher/reference
<i>Euphorbia hirta</i>	Unknown	Literature record	Wheeler et al. 1992
<i>Euphorbia hyssopifolia</i>	Unknown	New record	Howatharra, 2001, Annon
<i>Euphorbia stevenii</i>	Unknown	Literature record	Keighery& Longman 2004
<i>Phyllanthus amarus</i>	Nursery weed	Literature record	Keighery& Longman 2004
GERANIACEAE			
<i>Erodium brachycarpum</i>	Unknown	Literature record	Western Australian Herbarium1998-
LAMIACEAE			
<i>Ocimum tenuiflorum</i>	Herb	Literature record	Western Australian Herbarium1998-
LYTHRACEAE			
<i>Ammannia auriculata</i>	Crop weed	literature record	Hewson 1990
MALVACEAE			
<i>Abutilon grandifolium</i>	Ornamental	New record	Kenwick, 1999, G. Keighery 15867
<i>Malva nicaeensis</i>	Ornamental	Reviewed, 1996	Albany, 1992, Croxford 6740
<i>Sida rhombifolia</i>	Unknown	Reviewed, 1996	Burekup, 2/1981, D. Rose s.n.
<i>Sida subcordata</i>	Unknown	Reviewed, 1996	Cape Bouganville, 1989, G. Keighery 10707
MARTYNIACEAE			
<i>Martynia annua</i>	Ornamental	Literature record	Western Australian Herbarium1998-
MELIACEAE			
<i>Azadirachta indica</i>	Ornamental	New record	Kununnurra, 1995, A.A. Mitchell 4034
MIMOSACEAE			
<i>Acacia nilotica</i> subsp. <i>indica</i>	Fodder / shelter	New record	SE Wyndham, 2003, N. Wilson 0404
<i>Acacia saligna</i>	Crop/salinity	Literature record/ survey	

Albizia lebbeck	Ornamental	Literature record, Pilbara plants are definitely not native to area	Cowan 1998 gives as naturalised, native in Paczkowska & Chapman 2000
Prosopis glandulosa x velutina	Fodder, Shelter	Literature record	Perry 1998
MOLLUGINACEAE			
Glinus oppositifolius	Contaminant	Literature record	Keighery & Longman 2004
MYRTACEAE			
Eucalyptus camaldulensis	?Ornamental	New record	Coolup, 1996, G. Keighery 14366
Eucalyptus citriodora	Ornamental	New record	Kings Park, 1992, G. Keighery s.n.
Eucalyptus microcorys	Wood	New record	Margaret River, 1995, G. Keighery 14087
Kunzea baxteri	Ornamental	New record	Bluff Knoll, 1992, G. Keighery 12179
Leptospermum rotundifolium	Ornamental	New record	Nyamup, 1998, G. Keighery 15603
Melaleuca diosmifolia	Ornamental	New record	Bluff Knoll, 1992, G. Keighery 12178
Melaleuca linariifolia	Ornamental	New record	Blue Gum Lake, 1999, K. Brown 318
Melaleuca nesophila	Ornamental	New record	Two Rocks, K. Richardson 28
OLEACEAE			
Fraxinus rotundifolia	Ornamental	New record, previously Fraxinus sp.	Bridgetown, 1981, Keighery 4293
Syringia vulgaris	Ornamental	New record	Hovea, 1990, G. Keighery 11440
ONAGRACEAE			
Gaura lindheimeri	Ornamental	New record	Brunswick, 1996, G. Keighery 14349
OXALIDACEAE			
Oxalis compressa	Ornamental	New record, det. 1997	Toodyay, 23/7/1992, J. Dodd s.n.
PAPAVERACEAE			
Papaver somniferum subsp segiterum & subsp. somniferum	Ornamental	Collections redetermined by B. Lepschi, 1997	Divided into 2 varieties prev. only at species level

Table 2 (cont.)

Taxon	Reason Introduced	Record Source	Location /date/voucher/reference
PAPILLIONACEAE			
<i>Aeschynomene americana</i>	Unknown	New record, det. in PERTH by ST Reynolds 2001	Kununurra, 1992, A.A. Mitchell 2159
<i>Aeschynomene villosa</i>	Unknown	Revision, det. in PERTH, by ST Reynolds, 1988	
<i>Alysicarpus ovalifolius</i>	Unknown	New record, det. in PERTH by ST Reynolds, 1996	
<i>Astragalus pelecinus</i>	Crop	New record	
<i>Canavalia ensiformis</i>	Unknown	revision, det. in PERTH by R. Cowan, 1996	Northampton, 10/2001, B. Shepherd s.n.
<i>Centrosema pascuorum</i>	Crop	New Record	
<i>Desmodium scorpiurus</i>	Unknown	literature record	Kitto Station, 1999, A.A. Mitchell & Brockway 5675
<i>Desmodium triflorum</i>	Lawn weed	New record	Pedley 1999
<i>Indigofera glandulosa</i>	Native crop weed	Herbarium search	Kununurra, 1995, A.A. Mitchell 4042
<i>Kennedia nigricans</i>	Ornamental	New record	Kununurra Sugar Cane Crop weed, 1978, Aplin 6285
<i>Melilotus officinalis</i>	?Fodder	revision, det. 1994 by AE Holland	Waroona, 1996, G. Keighery 14413
<i>Psoralea aff. graveolens</i>	Fodder	Literature record	Possibly not naturalised, last record 1964
<i>Retama raetum</i>	Ornamental	Taxonomic change from <i>R. monosperma</i>	Possibly not naturalised, one old record in crop at Harvey 1991 collection determined 1999

Stylosanthes hamata	Crop	revision, det. in PERTH by AE Holland, 1998	
Stylosanthes scabra	Crop	revision, det. PERTH, by AE Holland 1996	
Trifolium resupinatum var majus	Crop	Revision, det. PERTH, by AE Holland 2002	Two varieties prev. one species, no varieties
Trifolium vesiculosum	Crop	Ag Dept records 2001	
Vicia sativa subsp. cordata	Crop weed	Revision, det. PERTH, by AE Holland 1993	3 subspecies, previously two
Vicia villosa subsp. eriocarpa	Crop weed	Revision, det. PERTH, by AE Holland 1993	
PASSIFLORACEAE			
Passiflora edulis	Crop	Literature record, new record, prev. Garden escape	Blackwood River, 1990, G. Keighery 11981
PLANTAGINACEAE			
Plantago coronopus subsp. commutata & subsp. coronopus	Unknown	Two varieties prev. one species	Wheeler et al. 2002
POLYGONACEAE			
Muehlenbeckia adpressa	Weedy native	Literature record, A.P.B. records	
Persicaria maculosa	Contaminant	Revision, det. KL Wilson, 1997	
Polygonum bellardii	Contaminant	Revision, det. G. Perry, 1996	
PRIMULACEAE			
Asterolimon linum-stellatum	Unknown	New record	Garden Island, 1994, G. Keighery 13138

Table 2 (cont.)

Taxon	Reason Introduced	Record Source	Location /date/voucher/reference
RANNUNCULACEAE <i>Myosurus minimus</i> var <i>australis</i> & ? var <i>minimus</i>	Weedy native	Considered native 1994, Briggs & Makin- son 2000 state that there are native (var <i>australis</i> ) and intro- duced varieties.	In W/A listed as a weed by Paczkowska & Chapman 2000
ROSACEAE <i>Acaena echinata</i> var <i>subglabricalyx</i>	Unknown	Species complex, 5 varieties naturalised not 4	NSW collection
<i>Rubus rugosus</i>	Crop	revision, det. DE Symon, 2001	
RUBIACEAE <i>Oldenlandia corymbosa</i> var <i>corymbosa</i>	pan tropical weed	Literature record, Herbarium and Survey records	All collections from weedy , man made or highly disturbed sites
<i>Richardia scabra</i> Spermacoce assurgens	?lawn weed Ornamental	New record New record	Beverley Springs, 1994, A.A. Mitchell 3678 Kununurra, 1999, T. Handasyde 99/94
RUTACEAE <i>Diplolaena dampieri</i>	Ornamental	New record	Woodvale N.R., 1996, G. Keighery 14389
SALICACEAE <i>Salix humboltiana</i>	Ornamental	New record	Bennett Brook, 2002, Keighery 16420
SAPINDACEAE <i>Cardiospermum grandiflorum</i>	Ornamental	New record	Lynwood, 1995, G. Keighery 14037



SCROPHULARIACEAE							
<i>Bacopa monnieri</i>	Ornamental		New record			South Perth, 1995, Lepschi et Lally 1837	
<i>Kickxia elatine</i> into subsp. <i>elatine</i> & subsp. <i>crinita</i>	Taxonomic review		New record			Recorded only as <i>K. elatine</i>	
<i>Linaria maroccana</i>	Ornamental		New record			Perth, 1995, Lepschi et Lally 1932	
<i>Lindernia crustacean</i>	Lawn weed		New record			Wyndham, 1992, A.A. Mitchell 2146	
<i>Nemesia strumosa</i>	Ornamental		New record			Pingelly, 1998, G. Keighery 15361	
<i>Veronica peregrina</i>	Unknown		Literature record			Briggs et al. 1992	
<i>Veronica plebeia</i>	Unknown		Literature record			Briggs et al. 1992	
SOLANACEAE							
<i>Datura leichhardtii</i>	Unknown		Prev. considered native			Cowie et al. 2001	
<i>Physalis angulata</i>	Unknown		Prev. considered native			Symon 1997, Cowie et al. 2001	
TAMARICACEAE							
<i>Tamarix pentaphylla</i>	Ornamental		New record			York, 2002, G. et B. Keighery 232	
TILIACEAE							
<i>Melochia pyramidata</i>	Unknown		revision, PERTH det. I. Cowie 1995				
<i>Corchorus trilocularis</i>	Unknown		revision, PERTH det. D.A. Halford, 1996				
<i>Grewia asiatica</i>	Ornamental		New record			Kununurra, 2000, A.A. Mitchell 6159	
<i>Tritumfetta pentandra</i>	Unknown		revision, PERTH det. DA Halford, 1994				
VALERIANACEAE							
<i>Valerianella locusta</i>	Crop weed		New record, 2003			S. Lloyd pers. com.	
VERBENACEAE							
<i>Phyla canescens</i>	Ornamental		revision, det. 1996			Munir, 1993	
<i>Verbena officinalis</i>	Ornamental		New record			Ludlow, 1998, G. Keighery 15165	
VITACEAE							
<i>Parthenocissus tricuspidata</i>	Ornamental		New record			Gingin, 22/3/1999, G. & B. Keighery s.n.	

## LITERATURE/TAXONOMIC CHANGES

There were 95 weeds added to the list by reviewing taxonomic revisions, Flora of Australia treatments, State and local flora treatments throughout Australia (Table 2). Others were from personal communication with weed workers in Western Australia. Sixteen of these were recorded in the tropical Kimberley, 5 in the desert and 74 from southern Western Australia. A significant component of these records were native Western Australian species acting as weeds in agricultural sites.

Taxonomic changes include species previously recorded without infraspecific categories recorded that now have been recognised, for example 2 subspecies or 2 varieties are recognized in *Agrostis capillaris*, *Acaena echinata* and *Papaver somniferum*.

There were several species previously considered as native that are stated as weeds in taxonomic revisions, e.g.: *Ammannia auriculata* or a number of native *Atriplex* species (7 species naturalized via salinity plantings) deliberately introduced outside their native ranges that are documented in the Flora of Australia treatment of the genus.

## REASONS INTRODUCED

Of the taxa listed in Table 2, 89 were introduced as ornamentals, 30 for agriculture (fodder, shelter

or wood), 12 are weedy Western Australian native species and for 51 methods of their introduction are unknown. The great majority of new weeds continue to result from deliberate introductions.

## DISCUSSION

By 2005 there were 1,239 naturalized vascular plant taxa recorded for Western Australia, composed of 12 Ferns, 15 Gymnosperms, 347 Monocotyledons and 865 Dicotyledons.

This paper highlights the importance of taxonomic studies of Australia's native and naturalised flora at a State and Australia wide level in uncovering and documenting previously unrecorded weeds. At least half of the "new" weed records from the survey period were the result of scrutiny of the available literature or taxonomic revisions of previously collected material. This suggests that supporting timely taxonomic scrutiny of current and past weed collections is vital to keeping out new and emerging weeds.

However, the documentation of the weeds of Western Australia displays a considerable lag time between discovery, identification and listing of new weeds, often exceeding 5–10 years. There are still many cases where species are listed as weeds in taxonomic reviews and/or revisions where this information has not been transferred to electronic databases. For example

*Ammannia auriculata* was listed as a weed of rice crops by Hewson (1980), but is still listed as native in Western Australia. Weed researchers and Herbaria need to actively search revisions to locate potential new weeds and establish clear guidelines to add these records to State and national databases.

As well there are numerous differences between States on the native or naturalized status of certain species, eg: *Helichrysum luteo-album* or *Cotula coronopifolia*. The continued development of Australia wide herbarium databases, especially the Australian Virtual Herbarium should reduce this problem. However, a national approach should not confer weedy or native status on difficult groups without caveats being transparent.

Increasing public awareness of all weeds, regular survey and the systematic survey of Northern Australia by the Australian Quarantine Inspection Service (AQIS) is leading to many new records. Unfortunately the number of new records is still increasing at approximately 10 per year over the survey period similar to past estimates Australia wide and shows little signs of slowing.

There is still a lack of awareness about the potential of both Australian and Western Australian natives to act as significant environmental weeds in Western Australia.

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